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HYDROLOGICAL WORK IN COMMUNIST CHINA

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FOREWORD

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HYDROLOGICAL WORK IN COMMUNIST CHINA

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Yueh-k'an (Hydrology Monthly), Peiping, No. 10, 15 October 1960.]

CONTENTS

<u>Article</u>	<u>Page</u>
GLORIOUS ACHIEVEMENTS ON THE CONSTRUCTION OF A NETWORK OF HYDROLOGICAL STATIONS DURING THE PAST DECADE	1
A DECADE OF HYDROLOGICAL FORECASTING WORK	7
A DECADE OF HYDROLOGICAL WORK ON THE YELLOW RIVER	14

GLORIOUS ACHIEVEMENTS ON THE CONSTRUCTION OF A NETWORK
OF HYDROLOGICAL STATIONS DURING THE PAST DECADE

[Following is a translation of an article written by the Station Network Control Office (K'o) of the Hydrological Bureau, in Shui-wen Yueh-k'an, No. 10, Peiping, 15 October 1960, pp 4-5.]

When we refer to the construction of a network of hydrological stations, the comrades who are working in hydrological activities are apt to think that the network of basic hydrological stations has been essentially completed. In addition, however, there are many special stations and the masses' hydrological stations that are vigorously developing. As a matter of fact, China already has a network of scientific hydrological stations apart from those many Special Stations and stations operated by the broad masses. The science of hydrology has been widely disseminated to the masses. As a result these matters are today well-known to the masses, and these activities are regularly performed by them. Looking back now, these things seem to be simple matters, but really they are not. They have gone through a glorious process. During this past glorious decade of China the Party has led us through a difficult struggle in this process. It is a victorious process of striving for another victory. It is a leap forward process. On the celebration of our tenth national holiday, under the Party's appeal for an anti-rightist movement encouraging high morale and the launching of an increase in production and economy movement, we look over the past decade concerning the construction of the network of hydrological stations and think over some of the heroic deeds that were achieved during this construction. Such memories give us endless strength and greater confidence to make further efforts to attain a continuous leap forward.

At the time of the Liberation in 1949 the reactionary Nationalist Government left behind 353 badly equipped hydrological stations with about 700 hydrological workers and some low-quality but unsystematic hydrological records. These were the documents of hydrological activities left behind by Old China. If we say that the hydrological activities of New China had any foundation at all, then these rudiments left from the old regime were our foundation.

In order to transform China's economic backwardness the Party and the People's Government, after the establishment of the People's Republic, rapidly launched a program of economic constructions. The struggle to prevent flood and drought disasters is one of the important

activities among these constructions. During the last several years floods and droughts have brought serious disasters upon the people of China. Under feudalism, bureaucracy and the oppression exerted by the imperialists these disasters never could be reduced or eliminated. After the establishment of New China great efforts were first exerted in these activities; large-scale irrigation constructions were undertaken to struggle against floods. Because of these reasons the construction of a network of hydrological stations was rapidly begun. During the last ten years glorious achievements were made.

In regard to the State-operated stations network during the economic recovery period of 1949 to 1952, the number of hydrological stations rose from the 353 in 1949 to 3,326 in 1952. During the First Five-Year Plan period the number of hydrological stations again doubled itself. Up to the end of 1957 there were 6,814 hydrological stations established throughout the country. This was 19 times the figure for 1949. 1958 was the "great leap forward" year. The construction of hydrological stations, as in all other constructions, made still greater leaps forward. In that year 2,800 stations were added; compared to those of 1957, in short, there was an increase of 42 percent. The most outstanding fact was that, during this year, the number of water-flow stations and experimental stations increased more rapidly. The increase of water-flow stations in 1958 equaled the total number of water-flow stations increased during the whole First Five-Year Plan period. The increase of experimental stations in that year surpassed the total number of experimental stations established during the whole First Five-Year Plan period by more than three times. In the construction of stations, under the Party's rectification movement and the struggle against the rightists and under the brilliance of the general line of the socialist construction, all the comrades working for hydrology manifested the communist character of dare to think, dare to say, and dare to act and showed courage and heroism by penetrating into primitive deserts and mountainous regions in the high plateaus to establish hydrological stations, and thus did they show the spirit of simple and dogged bravery. For instance, the comrades who were sent by Heilungkiang Province to go up the Ta-hsing mountain range to establish stations boldly said, "If we have legs, we have roads; if we have hands, we have houses; if we have guns, we have food / because transportation is very difficult in that region, supply is very difficult, so these people depend on their guns to secure food /; if we have men, we have stations." Such were their heroic slogans. At the same time, these were the things that they had done. They constructed the first group of hydrological stations on the Ta-hsing mountain range. During the last ten years there were many such heroic achievements. Because, under the leadership of the various levels of the Party committees and government agencies, all the comrades working for hydrology exerted their indomitable spirit, with the exception of some undeveloped areas a complete network of hydrological stations has been established covering every area throughout the country. At the end of 1958 there were already 9,700 hydrological stations established throughout China. In the first half of 1959 there were 169

water flow stations added, which was equivalent to 63 percent of the plan for the year. 173 experimental and tributary stations were constructed, which was equivalent to 80 percent of the total year's plan. This was an unprecedented great leap forward and it was a great victory for the Party's general line.

In the construction of the network of stations special emphasis must be given to the planning and construction of the network of basic stations. Before 1956 the method we used in the distribution of the stations was mostly based on the needs of engineering and flood prevention. Although this type of distribution, in the economic recovery period and in the early stages of economic constructions, was quite sufficient to meet the urgent needs of engineering and flood prevention at the time, now it is not enough to meet the needs of the various phases of the rapid developments of national economy if the former method were continued to be used. Consequently in 1956 the Soviet distribution experience was adopted, and with the assistance of a Soviet expert, Comrade A.A. So-k'o-lo-fu [Sokolov], the planning of the basic hydrological network of stations was carefully and scientifically made for the entire country. After three years of great effort this plan has basically materialized. The construction of the network of basic hydrological stations not only transformed the passive nature of the station distribution activities, but what is more important is the fact that China's hydrological calculations, information, forecasts, and scientific research were established on reliable foundations. This was one of the important achievements in the construction of the network of hydrological stations. This activity could only be accomplished in a socialist society, and it never could be done in a capitalist world.

It is not enough to judge the achievement of construction of the network of stations if we are to base our judgement on the basis of the number of stations established and on the plan of distribution. The high quality of the stations network and the expansion of its scope were also its important achievements. If we were to look at a hydrological station five years ago, it was merely a working unit, the only functions of which were water level observation, the survey of water flow and the amount of sand content. Three years ago the work of compiling data was added to the above-mentioned activities, and these constituted all the works to be done by a hydrological station. But now, under the policy of "all-out service" a hydrological station does most of the following works, i.e., that of an observation station, service station, and research station; it even serves as a guidance station for all hydrological activities performed by the masses, and it is no longer restricted to the mere testing and compilation of data. This is a great transformation which is the inevitable result in meeting the needs of socialist construction. This transformation has become more profound since the great leap forward in 1958. At present an ordinary hydrological station does not limit itself to the cross-section but to the coordination of the particular and overall aspects, so that the content and scope of its activities are vastly expanded. In addition to its regular work involving testing and compilation of data, a station is responsible

for such functions as hydrological investigations, hydrological calculations, hydrological forecasts, experimental research, and the task of giving directions to the masses for the operation of their hydrological works. In 1958 alone the comrades at the hydrological stations walked over 2,400,000 square kilometers to conduct hydrological investigations, and from now on they will continue to do this type of work regularly. In regard to hydrological calculations, the comrades at the hydrological station in Ning-an Hsien, Heilungkiang Province led all other stations. In the winter of 1958 they completed calculations for all hydrological records in this Hsien and did the calculation work for 152 water reservoirs. Under the conditions of the continuous great leap forward, and in order to meet the needs for irrigation constructions for this winter and next spring, there will be a vigorous mass movement for the calculation of hydrological records. It can be predicted that all the comrades working in the State-operated hydrological stations will do their best in this great movement. Hydrological forecasting has always been regarded as a profound and mysterious work. After the rectification movement's having abolished prejudices and established the communist character of dare to think, dare to say and dare to act, the All-China Hydrological Meeting held this year has issued an appeal, "Everybody can forecast, and every station must forecast." In about a little more than a half year's time more than 35 percent of the water flow stations have begun flood forecasting, which has received great praise from the masses for the superhuman accuracy of the forecasts. Experimental research works were also started at various stations and valuable achievements were attained. In the hydrological works among the masses the comrades at the State-operated stations edited textbooks, organized training classes and helped the masses to establish stations; all these had strong effects. At the same time, each of these working comrades has trained himself into a skillful worker, being able to conduct tests and also to do calculations. If we say that three years ago the works at the hydrological stations can be called "the vanguard and sharp soldier" in irrigation constructions, then we can call the works at the present hydrological stations "the sharp soldier and chief of staff" in irrigation, hydro-electric constructions and in agricultural production.

During the last ten extraordinary years, under the Party's consideration and guidance and with the efforts of all the comrades at the hydrological stations and through the unselfish assistance from the Soviets, China's network of hydrological stations was built from nothing to something and from the particular to the overall aspect, and it was rapidly developed in a vigorous manner.

But the achievement in the construction of a hydrological stations network during the last ten years was attained not only in the establishment of a network which contained many stations that were reasonably distributed and which had high quality, but most importantly under the shining light of the Party's general line and under the guidance of the policy of "walking on two legs" the achievement attained was in the creation of an unprecedented mass movement in the construction of the

network of hydrological stations. The term "Network of the Masses' Hydrological Stations" is very dear to us, but the reactionaries inside and outside of the country are afraid of it. The basic problem is that they are afraid of the masses, but on the other hand, everything we do is for the masses. Accordingly in the winter of 1957 T'an Chen-lin, secretary of the Party Central Committee, made the following suggestion at a discussion meeting for the control of the Sha-ying River in Honan Province: "There must be promoted a wide-spread mass irrigation engineering observation research activity to solve the series of new problems involved in the irrigation program. High enthusiasm for the mass movement in hydrology must be aroused within the country. A great number of peasants must be trained to serve as observation workers. A number of masses' hydrological stations must be established for the masses' own use. These stations for the masses must supply necessary information for the local and existing irrigation constructions and agricultural production." In the first half of 1959 after this activity had been adjusted, consolidated and improved, now no matter whether in the field of mass irrigation engineering control or in the direct service to agricultural production, a number of service methods have been discovered which have great utility in the facilitation of flood and drought prevention. The masses have universally welcomed them. The reason that the masses welcome the works of mass hydrology lies in the fact that within the last several years China's irrigation construction has undergone tremendous development, which is especially due to the natural trend created by the great number of mass irrigation engineering projects. In planning the design and engineering control over the mass irrigation engineering projects there is a wide-spread need for hydrological information and a control over hydrological fluctuations. Early in 1955 and 1956, in gathering data for irrigation planning, the Hsin-hsiang Special District in Honan Province already started mass hydrological activities. Accordingly as soon as Secretary T'an made the proposal appealing for the promotion of activities in mass irrigation engineering observation and research, there arose immediately a high enthusiasm for mass hydrological activities. After the establishment of the people's communes the development of mass hydrological works reached their highest peaks. This was due to the fact that the people's communes could solve some of the problems that the agricultural production cooperatives could not well solve, such as expenses and labor power involved in the construction of stations. The problems of expense and labor could not be solved by agricultural cooperatives, but the people's communes solved them with ease. From the standpoint of hydrological works, the people's communes possess an incomparable superiority over the cooperatives. The development of mass hydrology not only manifests the leaping development of China's economic construction but also shows that China's construction enterprise has gradually penetrated into the masses and that the scientific and cultural level of the masses has been universally raised. Science will emit a strong light and heat when the masses attain an understanding of science. The reason that mass hydrology has become so important is also due to this fact. But at

present there are still some persons who have rightist ideas and who entertain doubts against mass hydrology. They only noticed that at the beginning, some mass hydrological stations were unable to be consolidated due to the lack of adequate economic support, convincing them that mass hydrology was a failure. Furthermore they thought that there was something wrong in the policy of "walking on two legs", that is to say that "the State-operated stations network and the mass-operated stations network were to be operated at the same time." This attitude is completely erroneous. It must be criticised. The great fulfillment of the progressive nature of the network of State-operated stations is mass hydrology. Mass hydrology has brought great benefits to the people's practical living conditions, and this will also be the direction for our future development.

These glorious ten years have just elapsed. They have left us with confidence and high morale. It is believed that on this victorious road and under the able guidance of the Party and Chairman Mao, the construction of the network of hydrological stations will attain still greater victories.

A DECADE OF HYDROLOGICAL FORECASTING WORK

[Following is a translation of an article written by the Hydrological Forecasting Research Laboratory of the Hydrological Bureau, in Shui-wen Yueh-k'an, No. 10, Peiping, 15 October 1960, pp 6-8.]

I.

Hydrological forecasting is the "ear and eye" of flood prevention. It is the pivot upon which the whole operation of irrigation depends. In the Old China the hydrological activity itself was a lifeless affair, and there was nothing of importance in hydrological forecasting. During the ten years since the establishment of the New China the activity of hydrological forecasting has risen from nothing to something and from small to large. Following the leaping development of China's national economy this activity has rapidly grown up and become strong. Up until 1959, in addition to the forecasts of the rise and fall of the large and medium-sized rivers made by the central, provincial and special district government authorities, there were more than 1,100 observation stations making flood forecasts. Such an enormous army of forecasting personnel finds no parallel even in the most highly developed capitalist country. The attainment of this achievement is credited to the adoption of various correct policies by the Party at the various stages of development, close coordination of productive constructions, implementation of the general line of the masses, establishment of observation stations at the local level, and the brave manifestation of the communist character of dare to think and dare to act by the hydrological workers.

In the economic recovery period the Party's irrigation construction policy first laid emphasis on the prevention of the serious threat of floods, so the principal irrigation work was the repair of dikes and the control of key-points. Within the short time of three years the construction of the collection and distribution floodgates at the Jun River on the Huai River and the water distribution engineering project at the Chin River on the Yangtze River were completed. Because there were not enough reservoirs constructed at the time, flood prevention on these rivers was the most important task during the flooding seasons each year. In order to adopt correct flood prevention measures it was necessary to begin the gathering of hydrological information and the

forecasting activity. In 1951 the Hydrological Bureau began to introduce a number of foreign flood forecasting methods. In 1952 flood forecasts were formally started in the areas affected by the Yangtze River, the Huai River, the East and West Tributaries of the Pearl River and the Yung-ting River in North China. Flood forecasts were directly employed to help the construction of the water distribution engineering project at the Chin River, and obvious results were attained.

The First Five-Year Plan period can be said to have been the growing period for hydrological forecasting activities. In the "Outline (draft) for the All-China Agricultural Developments from 1956 to 1967" the Chinese Communist Central Committee requested that the general flood and drought disasters must be eliminated within seven to twelve years. Therefore the demand for hydrological forecasting became more urgent. During this period the scope of forecasting was expanded. Almost all large and medium-sized rivers that had flood possibilities had a flood forecasting system established. The content of forecasting was also increased; for instance, the prevention of disasters due to the melting of snow and the coordination of navigational needs were also included. In 1956 the forecasting of snow-melting was begun on the Yellow River and the Heilungkiang River. In order to meet the needs of the reservoirs for its planned comprehensive utilization for hydro-electric and irrigational purposes, there was a long-term forecast of the inflow to the reservoirs during the dry seasons, and medium and long-term forecasts were made regarding the river flow during the dry seasons. The accuracy of the forecasts was greatly improved. Generally the forecast concerning the elevation of water in large rivers and ordinary rivers had the difference of only one or two decimeters, while the amount of water flow might have a difference of 20 percent. A flood forecast discussion meeting was held in 1954 for the purpose of exchanging the many experiences accumulated from the various areas. After these experiences were correlated, revised, and supplemented by the Hydrological Bureau, Methods of Flood Prevention was published in 1955. This was the crystallization of the work of all hydrological forecast workers. At the same time, it accelerated the development of the flood forecasting activities.

In 1958 the Central Committee adopted the "three principal" irrigation construction policy. The irrigation construction movement increased in fervor in every area. The employment of flood prevention and engineering control measures started from a point and line and gradually developed into the entire area. The task of hydrological forecasting also increased greatly. In order to meet the needs under these new conditions an All-China Hydrological Forecasting Meeting was held in March 1958. A policy for the forecasting activities was adopted with the goal "to strengthen research, to promote all-out service, to give equal attention to floods and dry seasons, to coordinate the activities of the large, medium and small rivers and to give due regard to both quantity and quality." The meeting also decided to assign the task of forecasting to observation stations. In order to let the forecasting task reach down to the basic level the Central Committee and

the various local governments organized training classes for forecasting personnel in order to hand down the techniques to the masses. In March 1959 an All-China Hydrological Meeting was held at Ch'eng-chou, and a slogan was adopted that in the State's network of basic stations, "Everybody must be able to forecast, and every station must forecast." Within a year the total length of the rivers being covered by flood and dry season forecasts doubled that of the previous year. Up until August 1959 the total length of rivers covered by flood forecasts reached 82,000 kilometers, while that covered by dry season forecasts reached 20,000 kilometers, and that covered by snow-melting forecasts reached 10,000 kilometers. These figures did not include the river lengths covered by the hydrological stations operated by the masses.

In order to render the masses' hydrological stations to serve production better, the various areas trained a large number of peasants to become forecasting workers. According to incomplete statistics, in Anhwei and Kwangtung Provinces alone there were more than 1,000 peasants trained to serve as forecasting workers. Some mass stations that had attained outstanding results were commended by the local governments and the people's communes as advanced units, and they were awarded with flags in praise of their accomplishments. It is predicted that within one or two years the service of the masses' hydrological stations will attain greater development. At the same time, hydrological forecasting has attained remarkable scientific technical levels. China's general level of forecasting techniques can be seen from the compilation and publication of the book, Selected Essays Concerning the Exchange of Technical Experiences in Hydrological Forecasting, by the Hydrological Bureau.

II.

Hydrological forecasting has a dual purpose, i.e., the prevention of flood and drought disasters as well as the rational utilization of water resources. No matter whether it is irrigation construction, hydro-electric development, agricultural irrigation, water consumption in the cities and rural areas, or the safety of the towns and the communication lines, all have a very close relation to hydrological forecasting. In China's case, because rainfall concentrated in the summer and autumn and because the old regime left an obstacle in the form of shallow riverbeds and a system of worn-out dikes, the task of flood prevention becomes so much more difficult and the need for flood forecasting so much more urgent. Since the Liberation there have been several million men thrown into the struggle against flood every year. Thus many great victories were won over floods, safeguarding people's lives and property. Flood forecasting was intimately connected in these struggles, and fully functioned as the "ear and eye" and as the "chief of staff" and achieved marked results. For the purpose of illustration, there are the following examples:

In 1954 the Yangtze and Huai Rivers had the greatest floods. On 21 July a flood crest appeared at Ts'un-t'an in the upper reaches of the

Yangtze. The Hydrological Bureau and the Yangtze Commission immediately gathered information concerning the rainfall conditions at San-hsia and made a forecast saying that the water elevation at Sha-shih would surpass the flood distribution water level. The flood prevention departments immediately opened the inflow flood gates at T'ai-p'ing-k'ou, utilizing the Ching River flood distribution area to absorb the flood water to reduce the flood crest in order to guarantee the safety of the dikes below Sha-shih. In the evening of 3 August the Hydrological Bureau again made another forecast based on the rainfall conditions in the Chia-ling River region saying that the flood water elevation at Sha-shih would exceed the flood distribution water level by nine decimeters and that a volume of 2,500,000,000 cubic meters of flood water had to be distributed immediately in order to safeguard the great dike at the Ching River. At the time the Ching River flood distribution area had already absorbed the water of the previous flood. Consequently it was decided that the East Diike of the Hu-tu River must be opened in time to expand the flood absorbing capacity in this region. As a result of this action the great dike at the Ching River was saved. In the flood prevention struggle to safeguard Wu-han City, in order to reduce the threat on Wu-han City the lakes and lowland areas along the Yangtze were repeatedly used to absorb the flood water. On each occasion analyses and comparisons were made on the basis of the hydrological information and forecasts; then decisions were reached, striving to achieve the least sacrifice for the greatest advantage. In this year's Huai River flood prevention struggle, in order to use the Hung-tse Lake and the Ko-pao Lake properly for the purpose of absorbing the flood water to guarantee the safety of the Li-hsia River region in northern Kiangsu Province, the Hydrological Bureau, the Huai River Control Commission and the Kiangsu Provincial Huai River Control Headquarter, a half a month before, in accordance with the forecasts concerning the flow of water, all made correct calculations concerning the various flood control measures at the three river gates. Estimations were made as to the highest possible water level that might be reached in the Hung-tse Lake; subsequently effective measures were suggested to prevent flood water's becoming a disaster and to reduce the loss due to flood disaster to the minimum.

In the middle of June of this year the East, West, and North Tributaries of the Pearl River had the greatest flood in a hundred years. Because the Kwangtung Provincial Irrigation and Hydro-electric Commission, the Fo-shan, Chiang-men Special Administrative Offices made timely forecasts, the Provincial People's Council and the local governments were able to have tentative plans to make adequate preparations for flood prevention. After more than half a month's unflagging struggle against the flood carried on by the jointly volunteered services of the army and the people, the large dike on the North Tributary and the principal dikes in the North Tributary delta area were saved. Although an [almost] uncontrollable flood occurred on the East Tributary, the people's life and safety were protected and the principal dikes were safeguarded against breaking because of adequate hydrological informa-

tion and the timely assistances given.

Because the forecasting activity had reached down to the basic level, forecasting was promoted widely throughout the country; consequently results were attained everywhere. In 1958 the Meng-ch'eng Central Station in Anhwei Province made over 30 forecasts concerning the water flow from the Wo River at the two hydrological stations at Hao Hsien and Meng-ch'eng. The forecasts were accurate, satisfying the needs of flood prevention, namely the construction and control of the Wo River gates. These forecasts gained the confidence and support of the Hsien People's Council and other interested departments. The Hydrological and Weather Station of the P'ai-t'an People's Commune in Tseng-ch'eng Hsien, Kwangtung Province, made a timely forecast this year enabling the residents to move their material belongings to safety, avoiding death and loss to property. Other similar incidents occurred at Kuei Hsien, Tung-tien and Lai-pin in Kwangsi Province, at Chin-ping, T'ung-jen, Yu-ping and Yen-ho in Kueichou Province, at Hsin-ning and Ta-yung in Hunan Province and at Ts'un-chi, Hsi Hsien and Ho-li-chi in Anhwei Province. The hydrological stations in each of these areas achieved good results in their flood forecasting so that residents were able to move out in time, storage materials were rescued, transportation of timbers was properly arranged and construction of medium and small reservoir engineering projects was protected. These forecasts had great effects, and they were praised by the local Party Committee and government agencies and gained the support of the masses. The masses of Ta-yung Hsien had the following to say, "We cannot do away with the hydrological works; we know the coming of floods beforehand; the floods rise as high as they were predicted; we can make early preparations." The people praised the good results of these forecasts. It is not hard to imagine that these thousands of observation stations scattered over the whole country, each one doing its best, will naturally make enormous contributions to protect industrial and agricultural production.

Information concerning floods in the Yellow River due to snow-melting was forecast following the initiation of snow-melting forecasting. This information had great effects in breaking up ice and frozen snow blocks and in rallying the people to protect the dikes. These forecasts also rendered assistance to river navigation. Within the last several years dry season forecasts also attained excellent results in irrigation, electric generation, maritime navigation, raft transportation and construction activities.

III.

Following the pervasion of hydrological forecasting activities the creative labor of hydrological workers and their technical level of hydrological forecasting improved very rapidly. Because we have implemented the Party's policy of "coordinating scientific research with production practices," with respect to scientific hydrological forecasting, the practices of the last ten years have shown that this

policy has been absolutely correct, for it has solved production problems and raised the scientific technical level. Then what are the scientific and technical achievements made by hydrological forecasts during the last ten years? We believe that within the last ten years we were able to coordinate China's special characteristics of concentrated rain storms and extremely uneven distribution of rainfall through forecasting. With these flood forecasts we have principally solved the differences in the central position of rain storms, in the distribution of rainfall in rain storm areas and in the intensity of rain storms in connection with the water flow of the floods which affected the forecasting methods, i.e., those methods which included the water flow coefficient method (产流系数法) and the treatment of the unit line (单位线) technique. Next we coordinated the characteristics of the greater water flow at the central part of the river by proposing a sectional unit line (区间单位线) method of analysis, the revised method for the cross-section of flood waves in the curve of the river bed, coordination of the characteristics of the rapid rise and fall of flood water, the new curve of water currents (新的汇流曲线) and certain modifications of the Chia-li-ning / possibly transliteration of foreign name / current curve method.

A method has been discovered for the long-term forecasts concerning the water flow in the dry seasons for the rivers of northern China where water resource depends on subterranean water. This includes methods for meeting the effects caused by snow-melting and water used for irrigational purposes. In southern China there is some rainfall even in the dry seasons. But forecasts now can be made for a month's time concerning the volume of water flow during that particular period. A method is now under study for making longer periods of forecasting.

In regard to freezing conditions forecasting, forecasts concerning other freezing conditions have also begun besides the forecasting of river freezing and snow-melting. We now have a better understanding of weather characteristics of China's winters and the effects of geographical location, river characteristics, the shapes of the rivers and snow-melting upon the water flow. Forecasts have also begun to be made concerning the freezing conditions in the reservoirs. All these operations have attained good results.

Progress is now being made in utilizing high altitude weather phenomena as the basis of flood forecasting. This is an effective method in forecasting conditions in medium and small-sized rivers. In order to serve the medium and small-sized rivers more efficiently this method has been applied in the medium and small rivers in northern China. Results have already been attained from preliminary analyses.

IV.

The reason that China's forecasting activities secured such great achievements during the last ten years lies in the fact that it was the objective demand of the leaping development of socialist construction. It was also due to the Party's able guidance, the high morale

aroused by the Party, the effort to strive for the upper stream, the brilliance of the general line and the more, faster, better and cheaper way to construct socialism; all these have aroused and encouraged the entire body of comrades who have been working in forecasting to promote their spirit of acting practically, strenuously and skillfully. As a result they have attained these achievements. But we are not yet satisfied with just these results because there are still many problems that are waiting for immediate solution, for instance, the problem of long-term flood forecasts, the problem of how to coordinate irrigation to meet the effect of water flow from rain storms, and how to make proper forecasts, etc. Following the increased development of socialist construction there are more items involved in forecasting that must be further developed. We must defeat the rightist elements, arouse high morale, avoid being too proud or imprudent, but be modest in learning and put great efforts into research work. Under the brilliance of the Party's general line we must continue to struggle so that we will be able to welcome and to fulfill the still greater and more honorable tasks of the future.

A DECADE OF HYDROLOGICAL WORK ON THE YELLOW RIVER

[Following is a translation of an article written by the Hydrological Office of the Yellow River Water Conservancy Commission, in Shui-wen Yueh-k'an, No. 10, Peiping, 15 October 1960, pp 8-10.]

The hydrological work on the Yellow River includes the investigation and study of the law of change concerning the water of the Yellow River (including all tributaries of the Yellow River.) It is a service for completely preventing flood disasters caused by the Yellow River, for developing the Yellow River irrigation project and for progressing the national economy. All hydro-electric engineering projects, city construction programs, factories, mines, railroads, transportation, fishery, and national defence works that are connected with the Yellow River must make use of the Yellow River hydrological data and hydrological forecasts. The Yellow River flood prevention work, especially, needs the hydrological data and hydrological forecasts of the Yellow River. Therefore hydrological work on the Yellow River is one of the most basic activities in the Yellow River construction project and in the construction of the national economy. Precisely because of this the hydrological work on the Yellow River has grown from small to large following the establishment of the People's Republic and under the development and promotion of the Yellow River water conservancy movement guided by the various levels of Party Committees and government agencies. The hydrological work on the Yellow River, like the other activities of the nation, has also attained very great achievements. Especially after the rectification movement, with the high morale aroused by the Party, striving for the upper stream under the brilliance of the socialist general line that has been constructed by the more, faster, better and cheaper way, and with the encouragement manifested in the all-China great leap forward movement, the hydrological work on the Yellow River has had a leaping development and its achievements are remarkable.

Hydrological work is a service. In order to have a better service there must first be the establishment of a network of hydrological stations. Through this network of hydrological stations the hydrological changes of the rivers can be systematically observed and forecasted. The observed data must be recorded, carefully compiled and analyzed. Then this information must be published and distributed to the various departments for use.

I. The Construction of the Network of Hydrological Stations

The construction of the network of hydrological stations for the most part began in 1949 with the establishment of the Chinese People's Republic. We remember that at the time of the Liberation there were only 16 hydrological stations and four water elevation stations on the entire length of the Yellow River. These were the "achievements" attained by the Nationalist Government during the 30 years from 1919 to 1949. The number of these stations was pitiful, and their equipment was too scanty. In some stations there was only one hand-operated water level instrument in addition to several earthen vases. Consequently it was no wonder that the quality of their work was extremely inferior. Some stations merely borrowed a wooden boat and laid down a few floats on the river; from these they compiled the monthly volume of water flow data for the entire year. The workers at the stations took one checking at the water level of the river each day, then they made the report for the 12 hours on the basis of this one checking. This type of false information was no secret to the public. The technical level of the technicians was low and the number of technicians was very few. Almost all workers at the stations had other jobs or were connected with some other occupation. In order to earn a better living some workers undertook other manual work. In short, at the time of the Liberation, the hydrological stations we had accepted existed only in name. After the country was liberated, because of the Party's and the government's special interest in this work more workers were sent to the stations to re-organize them and develop them. After ten years the number of hydrological stations on the Yellow River, just to mention those under the jurisdiction of the Yellow River Water Conservancy Commission, has reached 142 and the number of water elevation stations reached 55. Besides these there are a great number of rainfall stations, hydro-chemical stations and evaporation stations. These stations, together with those hydrological stations established by the various provincial authorities along the Yellow River banks, form a more complete hydrological stations network and keep a stricter surveillance over the volume of water flow and sand flow in the trunk and tributaries of the Yellow River. In order to further strengthen control of the network of stations, raise work quality and avoid blind constructions an all-out investigation and planning took place in 1956 under the guidance of the former Irrigation Ministry and with the cooperation of the various provinces along the river to strengthen the network of stations covering the entire Yellow River region. This was a more scientific and rational distribution of stations. Up to the end of 1958 the network of all the stations in the Yellow River region was basically completed. The station construction task under the Yellow River Water Conservancy Commission was also completed at the same time. The equipment at the hydrological stations was gradually increased to meet the increasing needs from year to year. According to preliminary statistics, along the entire length of the Yellow River there are 94 transits, 859 current meters, 249 levels, and more than 90 automatic water elevation recorders (most of these instru-

ments are simple home-made instruments, some of them are of a rather low quality), over 100 large and small observation boats, four steamers, and 125 stations with ferrying equipment. In order to meet continuous developments, the number of workers was increased from year to year. Up to August 1959, on the whole length of the river there were 1,424 workers, of whom there were 754 cadre and 670 workers. This was a ninefold increase from those in 1949. This army of hydrological workers is scattered over a vast area stretching from the basin of the Yellow River at Ho-yen in Ching-hai Province down to the 750,000 square kilometer area of the tributaries at the mouth of the Yellow River. With boundless wisdom and firm determination these workers labored day and night for the good of the State's Yellow River water conservancy movement and for the good of the State's socialist construction enterprise. Especially after the rectification movement, under the brilliance of the general line they became more aware and liberated in their thinking. Thus with sky-high morale, and in spite of the most unfavorable surroundings and difficulties they faced the extremely cold weather which ran as low as 20° below zero. They risked their lives and worked on. They adopted the slogan, "The floods may rise to the sky, but to the sky we shall survey. As long as the flood does not recede, we shall not leave the fighting line." So they stubbornly fought the floods and the water flow from the melting snow. When the Party appealed to the cadre to become specialized and Red, all the hydrological workers responded enthusiastically. On the one hand, they joined the training program through labor, and on the other, they learned culture and technology. At present there is a group of workers who are well-trained for various types of work, such as Comrade Chou Tung-tai, who can pilot a vessel, survey floods and do various types of calculations.

II. Hydrological Surveying and Testing

Hydrological surveying and testing is the basis for hydrological works which serve production. Because the Yellow River has several characteristics, such as concentrated rain storms, high floods, high sand content, and swift currents, it is extremely important that there should be better surveying and testing operations, especially with respect to flood surveying and testing. During the last ten years we did much research work in this aspect. In the first few years we used floats to survey floods, but this method was not very accurate. After several years of groping and learning from outside experiences, we finally discovered a set of methods for flood surveying with current meters which adequately dealt with the characteristics of the Yellow River. Such methods include hydraulic-powered switches, suspension cables, heavy anchors and long cable operations. Other methods include boats ferried by suspension cable, the transportation of boxes by suspension cable and lastly the method of moving current meters across the river. These methods are convenient to operate and will not only reduce surveying time but also add greater safety features. Since the great leap forward in 1958 and following a technical revolution move-

ment launched on the entire length of the river, new techniques and surveying instruments were developed. The stations at Hsi-liu-k'ou, Lu-k'ou and Pa-li-hu-t'ung created a hydraulic machine which could survey currents and take sand samples automatically, while the Hou-ta-ch'eng Station created the one-man current survey method. Especially after the great leap forward in 1958 with the entire length of the river having launched a technical revolution, many hydrological stations realized the automatic recording system of water elevation and rainfall observation and survey, the mechanization of current survey and sand sampling, and the tabulation of surveying and testing calculations. Technical reforms not only reduce man power and decrease the strenuousness of bodily labor, but also greatly increase labor efficiency and raise work quality. The quality of the hydrological data obtained in 1958 surpassed that of any year. Now, under the Party's guidance, we are striving for the "four mechanizations." This well proves that once man's thinking has been liberated, boundless energy can be produced.

It has been said in the above that hydrological work is a service. It compiles all first-hand information obtained through observation and surveys. After careful revision and analysis they are published in book form, which is distributed to the various departments for their use. So since 1952, under the guidance and cooperation of the former Irrigation Ministry, Fuel and Industry Ministry and other related departments we organized a group comprised of more than 70 technicians, and within two years we completed the compilation of all hydrological information gathered prior to 1952 (including data obtained during the Nationalist regime from 1919-1949. At the time all data was scattered throughout the country; it was incomplete, and the quality was very inferior.) Beginning with 1953 we made a separate compilation of materials for each year. However we were unable at the time to publish the compiled data in the same year as it was gathered. In 1957 we raised the slogan of "four immediate steps and five guarantees", requesting all stations to make immediate survey, calculation, analysis, criticism, and compilation and at the same time to guarantee a complete compilation of all items, and also guarantee that the method was correct, that there were no mistakes in specification figures, that there was an answer to every question involved, and lastly that the task was to be completed on time. In 1958, particularly when the Hydrological Bureau suggested that it would publish the 1.4.7 compiled publications and the 3.6.9 goals, we were able to completely publish that year's data by August of the next year on the basis of guaranteed quality. This not only ensured speed in order to supply the various departments with the materials they needed, but also encouraged the hydrological workers to raise their work quality, train additional cadre and accumulate experience. The 1959 hydrological data inspected at the end of July and including all material prior to May was basically completed in its compilation.

For the last seven years (beginning with 1952) over 70,000 work days were put into the compilation of hydrological data, and the total amount of work constituted 13,862 station years, of which the volume of water flow constituted 1,707 station years, the volume of sand 1,644

station years, the volume of water lowered 6,677 station years, the volume evaporated 1,669 station years, weather 1,769 station years, subterranean water, granular analyses, and hydro-chemistry 396 station years. This hydrological information, besides being supplied to the flood prevention engineering, planning, designing, scientific research and the other departments for their use, was at the same time being furnished to various ministries of the Central Government, various committees, various provincial and district governments, various engineering projects, various scientific research institutions, and all colleges and universities. The distribution total was 178 units. According to recent statistics, i.e., just for the first half of 1959, the number of materials supplied to the various departments was 17,903 pieces, of which there were 4,597 pieces concerning hydro-electric power, 4,114 pieces concerning other industries, 1,121 pieces for highways, 2,174 pieces for maritime transportation, 747 pieces for city construction, and 467 pieces for national defence. The materials furnished to the various research institutions, colleges and universities were not included.

III. Hydrological Forecasting Work

The key to all-out service of the hydrological work on the Yellow River lies in the efficient collection of hydrological information and accurate hydrological forecasting. During the last ten years the work of hydrological information collection and hydrological forecasting, under the direct protection of the Party and high authorities, has grown up from nothing to something and from small to large. In 1949 during the great flooding period there were only 11 flood current reporting stations, and, at most, these stations merely relayed flood information. After ten years of great effort there were 314 flood reporting stations during the great flooding period in 1959. Of these there were 178 rainfall stations, 16 water elevation stations, and 120 water flow stations strictly controlling rainfall and flood information distributed from the T'ang-nai-hai area in Ch'ing-hai Province down to Ho-kou, a vast area at the mouth of the Yellow River. Snow-melting forecasts were formally started in 1952. From then until 1959 the number of snow-melting forecasting stations reached 58. In accordance with the needs of irrigation engineering constructions along the river dry season forecasting was begun in 1957. Until 1959 the number of dry season reporting stations reached 34. It can be said that, since 1957, hydrological information work became a regular year-round activity.

Forecasting work was principally connected with flood forecasting. It was started in 1951. At the time only simple diagrams were used, showing water elevation and the volume of water flow. The forecast only covered the 700 kilometers of the lower stream of the river, and the forecast was only effective one day ahead of time. Most other sections of the river had no forecast. The forecasts were made through estimates based on personal experiences, so their accuracy was not very high. In 1955 principal stations began to make forecasts concerning

flood crests and made related diagrams showing their correlation with rain storms. Formal forecasts were begun. In 1957 a large-scale mass movement was started along the Yellow River region for the promotion of irrigation and the preservation of soil. Various types of engineering projects were started. As a result great changes occurred in the natural elements that caused floods in the previous years. These changes brought about new tasks for hydrological forecasting. They also actuated the rapid development of hydrological works. In accordance with these new conditions we revised the various diagrams. At the same time flood forecasting expanded its scope to cover 67 sections of the river. The total length included in this operation was 8,350 kilometers with the effective period of forecasting reaching more than a week. Starting from 1959, in order to meet the various engineering and agricultural needs in the vast areas along the river, under the guidance of the hydrological forecasting policy adopted by the Hydro-electrical and Irrigation Ministry stressing "all-out service, strengthened research, equalized efforts for flood and dry season prevention, coordination of large, medium and small rivers, equal emphasis on universalization and high rising, and coordination of foreign and native methods", many water flow stations launched single station forecasting and revised weather forecasting. Forecasting methods were gradually raised from simple water elevation in relation to the volume of water flow to the analysis of causes. As such, forecasting accuracy was greatly raised. According to 1958 statistics accuracy generally exceeded 90 percent. In 1958 dry season forecasts were made only at important construction points (such as the San-men-hsia and the Cheng-chou Iron Bridge) and for very short periods. In the spring of 1959 new demands were raised with regard to various types of engineering constructions, especially the new problems arising from water consumption and distribution created by the industrial and agricultural great leap forward; so the mere short-term forecasts were not enough to meet the increasing needs. Under these new conditions we actively created dry season forecasting measures with the total length of 7,767 kilometers and the effective forecasting period extended from ten days to one month and a season. Freezing forecast was started in 1956. In 1959 forecasting covered the river length of 2,700 kilometers. So hydrological work on the Yellow River has entered into a new stage of all-out service.

Hydrological forecasting during the last several years, especially flood forecasting, has been successful in overcoming the great annual autumn flood of 13 years. These forecasts made great contributions and had active effects on all engineering constructions along the river. For instance, the Yellow River, in 1958, had a greater flood than the disastrous flood of 1933. The forecast of the water elevation at Huayuan-k'ou had a difference of only one millimeter from the actual height of the flood water. The Yellow River Flood Prevention Command Headquarter adopted protective measures based on these forecasts and on the estimates of the strength of the dikes and the strength of the masses, thus avoiding disaster. At the same time the two major engi-

neering projects, the construction at San-men-hsia and the construction of the Cheng-chou Bridge, were warned in time to take preventive measures; thus they were saved from disaster.

Following the gradual completion of the three major construction plans on the Yellow River and the rapid leap forward in industry and agriculture along the river, hydrological forecasting work on the Yellow River has become more important, especially since our operations still have many defects. This disables our operations from meeting the needs of the objective conditions. Therefore in the future we must put greater efforts into the study of the new changes brought about by these new conditions. We must do our best to raise the accuracy of the forecasts and prolong their effective period, so that we can be timely, fast, and accurate.

IV. Hydrological Scientific Experiments and Research

The various types of experiments and research work, following the progress of the Yellow River water conservancy program, have also been gradually established and developed. Since 1957 two river observation and survey teams and five experimental stations were established in the reservoir area, at the mouth of the river, and in the water flowing areas. These are new works; we had no experience, and the time was too short. While the work we did was not up to the mark, yet we gathered a great quantity of materials. For instance, data regarding the changes in the river bed at the lower stream of the Yellow River, its ability to hold sand, the observation and survey of the river bending and the river mouth, were gathered, and they were useful in designing the plan for the re-shaping of the course of the river and for the development of the river mouth. As in the San-men-hsia reservoir area, a survey was conducted on sedimentation. It became the basis upon which the preliminary plan for the construction of a large reservoir might be made; it helped to make timely alterations on the shore line of the reservoir and on the curve line of the outlets. It also contributed practical data with which hydrological forecasting became more accurate. It must be pointed out here that in order to understand human economic activities, we must know the effects of the Yellow River floods, annual water flow and the amount of sand carried by it. This year, under the guidance of the Irrigation and Hydro-electric Ministry, we cooperated with the various provincial and district governments, scientific research, planning and designing departments and the various colleges and universities to begin an irrigation and water preservation research project. This is a very important task. Because everybody exerted his great efforts, certain results have been attained. It is now estimated that by the end of the year a preliminary report on this work will be completed. In short, these research projects have been listed in the agenda of the Yellow River hydrological program, and it is planned that 50 special essays will be written on this subject within the year. In addition, other research projects are being conducted in the fields of hydrological experimentation, sediment testing, and hydrological forecast-

ing.

In addition to the above, we have been offering our services to the local authorities for the past ten years, for example in hydrological statistics, compilation of local hydrological handbooks, forecast handbooks, surveying of sewage systems, the use of trained observation workers, guidance to mass hydrological stations, etc. As a result the masses have given us favorable comments. Many units received praises from the local authorities and the masses.

V. Conclusion

As it has been shown, hydrological work on the Yellow River during the last ten years has been in a process of continuous growth and increasing strength. It has attained great achievements. It has been the Party's victory. It has been the glorious victory of the general line. It has been the victory of the entire body of hydrological workers who had sky-high morale and whole-hearted enthusiasm. But because our political awareness and technical level are still very low, there are still defects and mistakes in our work; thus we are still unable to satisfy the needs of the new conditions created by the great leap forward. Therefore from now on, under the correct guidance of the Party and our superiors, rallying around the Party, listening to what the Party says, obeying the Party's instructions, arousing high morale, striving for the upper stream, with the "more, faster, better and cheaper way" to construct socialism and under the brilliance of the general line, we must march forward victoriously. All workers must not be either too proud or imprudent. We must continue to learn Marxism-Leninism and the Party's policy and Chairman Mao's writings. We must learn science, culture, and technology. We must constantly raise our political awareness and technical and cultural level. We must do our best to raise the quality of our work, overcome our weak points and offer an all-out service. We believe that under the Party's correct guidance we can definitely attain still greater victories.